

CLAIMS

We claim:

1. Apparatus for the automatic interpretation of a waveform of a breath of a subject.
2. Apparatus according to claim 1 and wherein said waveform is obtained from a capnographic analyzer.
3. Apparatus for the diagnosis of the respiratory state of a subject by computer analysis of at least one breath waveform obtained from said subject.
4. Apparatus according to claim 3 and wherein said breath waveform is obtained from a capnographic analyzer.
5. Apparatus for computerized breath analysis comprising:
 - a breath receiver in fluid communication with a subject;
 - a breathing analyzer coupled to the breath receiver and operative to analyze breathing of said subject and provide at least one output; and
 - a respiration diagnosis generator providing an indication of the respiratory status of the subject based on at least one output of said breathing analyzer.
6. Apparatus for computerized breath analysis comprising:
 - a breath receiver in fluid communication with a subject; and
 - a breathing analyzer coupled to the breath receiver and operative to analyze breathing of the subject and to provide an indication of the difference between the end tidal carbon dioxide partial pressure and the arterial carbon

dioxide partial pressure of said subject.

7. Apparatus for computerized breath analysis comprising:

a breath receiver in fluid communication with a subject; and
a breathing analyzer coupled to the breath receiver and operative to analyze breathing of the subject and to provide an indication of the arterial carbon dioxide partial pressure of the subject.

8. Apparatus for computerized breath analysis according to claim 6 and also comprising:

a respiration diagnosis generator providing an indication of the respiratory status of the subject based on said indication of said difference between end tidal carbon dioxide partial pressure and the arterial carbon dioxide partial pressure of the subject.

9. Apparatus for computerized breath analysis according to claim 7 and also comprising:

a respiration diagnosis generator providing an indication of the respiratory status of the subject based on said indication of the arterial carbon dioxide partial pressure of the subject.

10. Apparatus according to claim 5 and wherein said breathing analyzer includes a capnograph.

11. Apparatus according to claim 6 and wherein said breathing analyzer includes a capnograph.

12. Apparatus according to claim 7 and wherein said breathing analyzer includes a capnograph.

13. Apparatus according to claim 5 and wherein said breathing analyzer performs analysis of at least one breath waveform.

14. Apparatus according to claim 6 and wherein said breathing analyzer performs analysis of at least one breath waveform.

15. Apparatus according to claim 7 and wherein said breathing analyzer performs analysis of at least one breath waveform.

16. Apparatus according to claim 13 and wherein said breathing analyzer operates in a frequency domain.

17. Apparatus according to claim 16 and wherein said breathing analyzer analyzes changes in the frequency spectrum of said breath waveform for detecting changes in the respiratory status of said subject.

18. Apparatus according to claim 13 and wherein said breathing analyzer compares at least part of said breath waveform with at least one reference.

19. Apparatus according to claim 13 and wherein said breathing analyzer analyzes variations in at least part of said breath waveform over time for detecting changes in the respiratory status of said subject.

20. Apparatus according to claim 5 and wherein said respiratory diagnosis generator provides an indication of the respiratory status of the subject based on a capnographic measurement, and also on at least one output of at least one of:

a breathing flow rate measurement;

a breathing volume measurement;

an analysis of the amount of at least one other gas in the breath;
a measurement of cardiac output;
a pulse oximetric measurement; and
an ECG measurement.

21. Apparatus for providing an indication of the respiratory state of a subject, comprising:

a gas analyzer which provides at least one time-dependent waveform of the partial pressure of carbon dioxide in the breath of a subject;

an input circuit for receiving a sequence of digitized signals derived from said at least one waveform;

a signal processor for analyzing said at least one waveform for at least one parameter which characterizes a property of said waveform;

a parameter comparator for comparing said at least one parameter with a predefined parameter which characterizes the same property of a waveform obtained from a normal subject; and

a diagnosis generator which generates a message in accordance with the output of said parameter comparator.

22. Apparatus according to claim 21 and wherein said gas analyzer is a capnograph.

23. Apparatus for providing an indication of the respiratory state of a subject, comprising:

a gas analyzer which provides a plurality of time-sequenced waveforms of the partial pressure of carbon dioxide in the breath of a subject;

an input circuit for receiving a sequence of digitized signals derived from said plurality of time-sequenced waveforms;

a signal processor for analyzing said plurality of time-sequenced

waveforms for determining changes with time in at least one parameter of said plurality of time-sequenced waveforms;

a trend analyzing unit for comparing said changes with time in said at least one parameter of said plurality of time-sequenced waveforms, with predefined changes with time in the equivalent said at least one parameter of time-sequenced waveforms typical of patients with known respiratory deficiencies; and

a diagnosis generator which generates a message in accordance with the output of said trend analyzing unit.

24. Apparatus according to claim 23 and wherein said gas analyzer is a capnograph.

25. Apparatus according to claim 23 and wherein said respiratory deficiencies arise from deficient ventilation.

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This embodiment is particularly useful for monitoring patients undergoing high frequency ventilation. In analyzing the frequency components, the existence of a very low beat frequency may be indicative of the presence of a zero or near-zero breathing zone. The instrument is then programmed to issue a warning to the attending medical staff to move the ventilating frequency away from its present value.

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described hereinabove. Rather the scope of the present invention includes both combinations and subcombinations of various features described hereinabove as well as variations and modifications thereto which would occur to a person of skill in the art upon reading the above description and which are not in the prior art